

## CLAIMS

1. In a single or two stage pulse tube refrigerator comprising a working gas, a compressor, one or more pulse tubes, one or more regenerators and a buffer volume, the improvement comprising adding a rectification circuit to change the pulsating flow into and out of the buffer volume to circulating flow, where the rectification circuit includes a cooling means.
2. The refrigerator of claim 1 where the rectification circuit includes one or more passive orifices at the hot ends of the pulse tubes through which the gas flows to achieve phase shifting.
3. The refrigerator of claim 1 where the rectification circuit is the buffer volume.
4. The refrigerator of claim 1 that is a two-stage pulse tube refrigerator.
5. The refrigerator of claim 4 that is a two-stage pulse tube refrigerator with double orifice control.
6. The refrigerator of claim 4 also having interphase control.
7. The refrigerator of claim 1 also comprising a bypass channel connecting through restrictors the warm end of the regenerators with the hot ends of the pulse tubes.
8. The refrigerator of claim 1 in which the hot end of the pulse tube is remote from the line connecting the compressor to the warm end of the regenerator.
9. The refrigerator of claim 1 where the rectification circuit includes cooling fins.